Thomas Jefferson National Accelerator Facility

12000 Jefferson Avenue, Newport News, Virginia 23606 • Phone (757) 269-7689 • Fax (757) 269-7398 • www.jlab.org

Aerial view of accelerator site

Significant Dates

1984	Newport News site selected; received initial federal funds.
1987	Construction on the accelerator underway.
1994	Physics experiments started.
1995	Design energy of 4 GeV (billion electron volts) reached.
1996	Name changed from CEBAF to the Thomas Jefferson National Accelerator Facility.
1996	Construction of Free-Electron Laser facility started.
1997	Full design energy—4 GeV—delivered to all 3 experimental halls.
1998	Free-Electron Laser achieves first light—28 times existing power record.
2000	~ 6.0 GeV beam to experimental halls.
2000	JLab awarded ~$70M contract to engineer and assemble cryomodules for the Spallation Neutron Source (SNS) in Oak Ridge, Tennessee.
2001	Design underway to upgrade energy of accelerator to 12 GeV and build a fourth experimental hall.
2001	Started construction of FEL upgrade to 10 kilowatts; completion Fall 2002.

What is Jefferson Lab?

Jefferson Lab is a U.S. Department of Energy national laboratory built for nuclear physics research. As a user facility for university scientists worldwide, its primary mission is to conduct basic research that builds a comprehensive understanding of the atom's nucleus. With industry and university partners, it has a derivative mission as well: applied research for using Free-Electron Lasers based on technology the Laboratory developed to conduct its physics experiments. As a center for both basic and applied research, Jefferson Lab also reaches out to help educate the next generation in science and technology.

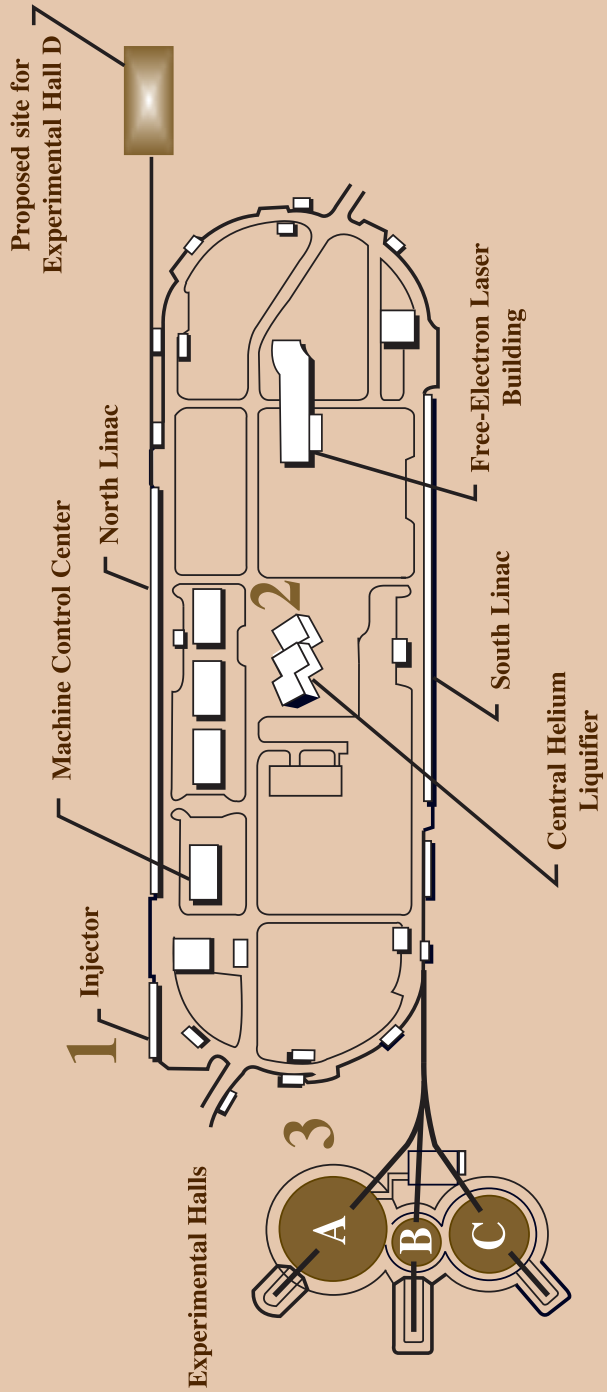
What makes Jefferson Lab Unique?

Superconducting electron-accelerating technology makes the Laboratory unique. Researchers use Jefferson Lab's Continuous Electron Beam Accelerator Facility (CEBAF)—the technology's first large-scale application anywhere—to conduct experiments. With high-energy electron beams from the accelerator, experimenters probe the subnuclear realm, revealing for the first time how quarks make up protons, neutrons, and the nucleus itself. Using this same superconducting electron-accelerating technology, Jefferson Lab and industry have constructed a laser of unprecedented power and versatility called a free-electron laser. This laser offers unique capabilities for basic research and manufacturing processes.

Jefferson Lab Facts

- Jefferson Lab is managed and operated by the Southeastern Universities Research Association (SURA), a consortium of 59 universities, under a contract with the U.S. Department of Energy. Twelve of the SURA universities are located in Virginia.
- Jefferson Lab represents a $600 million investment by the federal government, the Commonwealth of Virginia, the City of Newport News, foreign contributors, and the U.S. nuclear physics research community. The annual operating budget from the Department of Energy is approximately $73M per year.
- Approximately 600 people are employed at Jefferson Lab.
- More than 1,500 scientists from around the world conduct experiments at Jefferson Lab.

Accelerator Site



How Does the Continuous Electron Beam Accelerator Work?

1 The electron beam begins its first orbit at the injector and proceeds through the underground racetrack-shaped accelerator at nearly the speed of light.

2 The accelerator uses superconducting electron-accelerating technology to drive electrons to higher and higher energies. A refrigeration plant, the Central Helium Liquifier, provides liquid helium for ultra-low-temperature (-456ºF) superconducting operation.

3 The electron beam can be split for use by three simultaneous experiments in the end stations, which are circular, domed chambers with diameters ranging from 98 to 172 feet. Special equipment in each end station records the interactions between incoming electrons and target materials. The "continuousness" of the electron beam is necessary to accumulate data at an efficient rate and yet ensure that each interaction is separate enough to be fully observed.

Did you Know?

CEBAF is the world's most powerful microscope for studying the nucleus of the atom.

If CEBAF weren't superconducting, it would require three times as much power to operate and performance would be greatly reduced.

The accelerator tunnel is built 25 feet below the earth's surface on the "Yorktown Formation"—an old sea bed.

Approximately 25,000 cubic yards of concrete were used to build the tunnel—the equivalent of 12 miles of concrete trucks lined up end-to-end.

More than 2,200 magnets in 58 varieties focus and steer the electron beam. They range in size from a few inches to three yards and weigh as much as five tons.

Hall B can collect one Terabyte of data per day. That's enough data to fill the fronts and backs of a stack of bond paper six miles high.

The electron beam travels around the 7/8-mile tunnel five times in 21 millionths of a second. At that speed, the electron beam could circle the earth 7 1/2 times in one second.

The mass of an object increases as its speed increases. At nearly the speed of light, the electrons increase in mass 7,916 times.

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